SINGAPORE REPORTS

Public Prosecutor v Ang Soon Huat

HIGH COURT (SINGAPORE) — CRIMINAL CASE NO 34 OF 1987
CHAN SEK KEONG AND CHUA JJ
1 OCTOBER 1990

Criminal Law — Dangerous drugs — Trafficking in — Diamorphine — Weight of drugs — Process of measuring weight — No evidence of homogeneity of drugs — Whether prosecution had proved beyond a reasonable doubt that accused trafficked in more than 15g of diamorphine — What amounts to 'beyond a reasonable doubt' — Misuse of Drugs Act (Cap 185, 1985 Ed), ss 5(a) & 33

Constitutional Law — Equal protection under the law — Scientific testing of weight of drugs — Constitution of the Republic of Singapore, art 12(1)

Evidence — Computer printouts, admissibility of — Evidence Act (Cap 97, 1985 Ed), ss 35 & 67

Evidence — Expert evidence — Conflict of expert evidence — Burden on prosecution to produce additional evidence

The accused was arrested after a trap was laid for him to sell a quarter of a pound of heroin to a Central Narcotics Bureau ('CNB') officer. A plastic packet containing a pinkish granular substance was found in the glove compartment of his car. This substance was tested by the Department of Scientific Services ('DSS') and was certified to contain not less than 18.77g of diamorphine.

The defence contended that when the DSS's calculation (based on their normal methods used in all other cases of trafficking) was found to be incorrect, the prosecution was not entitled to justify their calculation on some other method or formula as this would deprive the accused of his right to equal protection of the law under the Constitution. The defence further contended that the computer printouts of the results of the chromatograms and spectograms were inadmissible. Finally the defence called into question the procedure used to test the weight of the exhibit, and to support this the defence called its own expert evidence.

Held, convicting the accused of trafficking in not less than 10g and not more than 15g of heroin:

(1) The justification of the scientific officer's analysis on some other basis which is not scientifically invalid is not arbitrary. There is no constitutional protection against the application of correct scientific formulas and facts to any prosecution of accused persons.

(2) The computer printouts of the results of the chromatograph and spectogram tests were real evidence as the computers not only recorded but also processed and calculated the information fed into them and oral evidence had been given in regard of these matters. Section 35 of the Evidence Act (Cap 97, 1985 Ed) only applies if the computer printouts are put in as evidence of the facts stated therein without more.

(3) For the purpose of evaluating a scientific experiment or a laboratory analysis, the written record is absolutely vital. The laboratory procedure prevailing at the time the tests were done on the exhibit were not sufficiently rigorous in terms of the standards required of scientific analysis of drugs.

(4) There was no evidence that the exhibit, after it was grounded, was homogenous or rendered sufficiently homogenous by the taking of three samples therefrom. There was also insufficient evidence that the three samples were taken randomly from the exhibit.

(5) No experimentally verifiable and verified evidence was adduced to show that the taking of three samples with a total weight less than 46% of the weight of the original exhibit was a valid or sufficient procedure to obtain a representative sample of the exhibit.

(6) The prosecution had therefore not proved beyond a reasonable doubt that the weight of the heroin as calculated from the analysis of the three samples was representative of the remaining 99.5% of the exhibit.

(7) There was a dispute between the prosecution and defence experts as to the calculation of the coefficient variant. In the face of such a dispute it was incumbent on the prosecution to produce additional expert evidence. No such evidence was adduced. A reasonable doubt had therefore been thrown on the validity of the prosecution evidence on this point.

(8) If there was only a remote possibility in favour of the accused, a case may be said to be proved beyond a reasonable doubt. However the court was unable to say that there was only a remote possibility in favour of the accused. Neither was there any fact on which the court could draw an inference that the quantity of heroin was more than 15g.

(9) Where the court was in doubt as to whether the accused committed an offence in a lower or higher degree of seriousness, the court should make a finding in the lower degree, particularly where the sentence of death was involved.

Cases referred to

1 *Haw Tua Tau* v *PP* [1981] 2 MLJ 49 (folld)
2 *Press Trust of India* v *Union of India* AIR 1974 SC 1044 (refd)
3 *Yick Wo* v *Hopkins* [1886] 118 US 357 (refd)
4 *Howe Yoon Chong* v *Chief Assessor & Comptroller of Property Tax* [1990] 1 MLJ 321 (folld)
5 *Aw Kew Lim* v *PP* [1987] 2 MLJ 601 (refd)
6 *R* v *Wood* [1972] 76 Cr App R 23 (follld)
7 *Castle* v *Cross* [1985] 1 All ER 87 (folld)
8 *Garner* v *DPP* [1990] 90 Cr App R 178 (folld)
9 *Re JS (A Minor)* [1980] 1 All ER 1061 (folld)
10 *Miller* v *Minister of Pensions* [1947] 2 All ER 372 (folld)
11 *R* v *Van Beelan* [1973] 4 SASR 353 (folld)

Legislation referred to

Evidence Act (Cap 97, 1985 Ed) ss 35, 67
Misuse of Drugs Act (Cap 185, 1985 Ed) ss 5(a), 33

Chan Seng Onn (Deputy Public Prosecutor) for the Public Prosecutor.

Kan Ting Chiu for the accused.

Cur Adv Vult

Chan Sek Keong J (delivering the judgment of the court): The accused, Ang Soon Huat, was charged as follows:

> You, Ang Soon Huat, on or about the 29th day of September 1986 between 10.50pm and 11.15pm, in Singapore, did traffic in a controlled drug specified in Class 'A' of the First Schedule to the Misuse of Drugs Act (Cap 185), to

wit, by transporting one plastic packet of drug containing not less than 18.77g of diamorphine in motor car JBJ 3072 from Immigration Woodlands Checkpoint to the carpark at Woodlands Cinema without any authorization under the said Act or the regulations made thereunder and you have thereby committed an offence under section 5(a) and punishable under section 33 of the Misuse of Drugs Act.

Case for prosecution

The evidence adduced by the prosecution proves beyond any doubt that the accused did traffic in a quantity of diamorphine on the day and time in question. The accused was arrested near his car and a plastic packet was found in the glove compartment thereof as a result of a trap laid for him by the officers of the Central Narcotics Bureau. The entrapment was made possible when the accused tried to reach one Lim Lye Huat through Lim's pager when Lim was in the custody of the CNB officers after his arrest for trafficking, possession and consumption of a similar drug. Lim was instructed by a CNB officer to arrange for the officer to buy about a ¼ pound of heroin from the accused. The arrangement was successfully made and it led to the arrest of the accused with a plastic bag containing a pinkish granular substance.

The evidence adduced by the prosecution to prove that the weight of the diamorphine in the plastic packet was not less than 18.77g is as follows. After the accused was arrested, he and his wife (who was with him in the car at the time of the arrest) were taken to CNB headquarters. The plastic packet and all the other things that were seized from the accused and his wife were also brought to CNB headquarters. The packet was weighed on 30 September 1986 and found to weigh 111.4g.

According to NO Lee Kiong Lock, he sent the plastic packet to the Department of Scientific Services ('DSS') on 30 September 1986 at about 11.40am for analysis and report. DSS received the packet and an analysis was done. For convenience, we shall hereafter use the expression 'the exhibit' to refer to the contents of this plastic packet.

The accused has not challenged this part of the prosecution's case. What he has challenged was the weight of the diamorphine in the exhibit. It is therefore necessary to review the prosecution evidence on how the weight of 18.77g was arrived at by Dr Chow.

(1) Testimony of Loh Chung Sin (PW7): Loh was a senior laboratory technician (since 1980) in the DSS with about 16 years' of work experience. On or about 1 October 1986, he received from Dr Chow the plastic packet. He then weighed the packet on a semi-micro balance (ie a balance that is accurate to four decimal points) which, in accordance with laboratory procedure, he had checked for accuracy prior to the weighing. He found that the weight was 111.4529g. He then slit open the packet and emptied the contents into a blender which was kept clean and dry for that purpose. He then weighed the empty plastic packet and found it to be 1g exactly, thus giving a net weight of 110.4529g for the granular substance.

Loh then started the blender and allowed it to operate for five minutes. He then repeated the process twice. He said that after the first operation, the substance was about 95% pulverized and that after the third operation, the substance was completely pulverized into a fine powder. (We have inspected the exhibit tendered in court and agree that it is a fine powder but it was then in a hardened form.) After the blending, he then put the powdered exhibit into a pre-weighed plastic bag. He then took a small amount of the powder and put it into three crucibles for the purpose of testing the presence of heroin by means of three kinds of colour reactive tests known respectively as the Marquis Test, the Frodhes Test and the FeCl3 Test. These tests confirmed the presence of heroin in the samples. Loh also used another sample from the bulk to perform a thin layer chromatography test which also proved the presence of heroin in the powder.

After these screening tests, Loh proceeded to perform the quantitation test. First, he again checked the accuracy of the micro-balance within the range for which the powder was to be weighed by using weights of 1g and 2g. He found the balance accurate. He then placed a weighing paper (a piece of smooth glazed paper) on the balance and noted its approximate weight. He then took a sample of the powder and put it on the paper and found that the balance registered a weight of 0.2631g. Then he poured the powder into a 25ml volumetric flask and weighed the weighing paper again. He found the weight was 0.1036g, thus giving a net weight of 0.1595g to the first sample (sample A). He repeated the same procedure in respect of two other samples and their weights were 0.2580g – 0.1038g = 0.1542g (sample B) and 0.2599 – 0.1067g = 0.1532g (sample C). The total weight of the three samples was therefore 0.4669g. Loh said that the three flasks were clean and dry. To a question from the DPP, Loh said that he took the three samples 'from as far away from each other as possible'.

Loh's next step was to add methanol (HPLC grade) to the flasks so that they were ¾ full, stoppered them tightly and put them in an ultra sonic bath (a device which broke up and dissolved the powder by means of high intensity pulses) for about 10-15 minutes. He did not remember how many times he did this but he was satisfied by visual inspection that the powder had completely dissolved. He then removed the flasks from the bath and topped them up with methanol to the 25ml mark and shook the flasks in order to ensure a complete mixing of the solution. After that, he used three different pipettes (which were dry and clean) to take out 1ml of each of the three solutions which he emptied into three separate 5ml stoppered tubes. A fourth tube was

used to contain an internal standard solution which was prepared separately for calibrating the instrument to be used. This solution contained known standard weights corresponding with the components of the samples. The components were: (1) caffeine (1.539mg), (2) monoacetyl morphine (0.495mg), (3) heroin (1.795mg), (4) acetyl codeine (0.468mg). Having prepared the four tubes, Loh then put into each of these four tubes, 1mg of nalorphine internal standard (in liquid form).

The aforesaid four tubes were prepared for quantitative analysis of heroin by a method known as 'high performance (or pressure) liquid chromatography' ('HPLC'). For this test, a Philips Pye Unicam instrument was used.

Loh then prepared another set of five tubes. In the first tube, he put in 1ml of sample A; in the second, 1ml of sample B and in the third, 1ml of sample C. The fourth tube contained 1.795mg of heroin internal standard which was dissolved in methanol (HPLC standard) for the purpose of calibrating the instrument. The fifth tube contained a quantity of sample A which was used to confirm the presence of the heroin. Into these five tubes, Loh also added 1ml of deuterated heroin internal standard (which was pure heroin commercially manufactured). After preparing these five tubes, Loh handed them to his colleague, another senior laboratory technician in the DSS, Tan Wang Chwee, for testing by a method known as gas chromatography-mass spectography ('GCMS'). The instrument that performed the tests was a Hewlett-Packard 5985B GC/MS which DSS purchased in about 1980.

To perform the HPLC analysis, Loh put the four tubes in bottles specially designed for this purpose in a carousel in their order of rotation, ie the first bottle containing a wash solution (methanol), followed by the tube containing the internal standard, followed by another wash, followed by the test tube containing sample A, and so forth, giving a total of eight bottles. The instrument was started and it eventually produced printouts of the chromatograms of the various samples. Loh identified the printouts as follows: P14 (sample A), P15 (sample B), P16 (sample C) and P17 (internal standard). Each of P14-17 showed two chromatograms as two injections of the samples were used. After that, Loh collected the printouts and handed them to Dr Chow for analysis and calculation.

Under cross-examination, Loh made the following statements in answer to questions put to him in that order:

(1) that he was taught the HPLC analysis by Dr Chow who had devised the method;

(2) that he had followed the procedures strictly in accordance with a laboratory manual ('manual') prepared by Dr Chow;

(3) that he was instructed by Dr Chow to weigh the samples in the usual way and that Dr Chow was present when he did the weighing but not when he prepared the samples for analysis;

(4) that he had recorded what he had done in P23; that for instrumental procedures he would follow the manual;

(5) that there was no standard procedure to homogenize granular substances, but that the use of a blender 3 × 5 minutes was a most effective way of homogenization, and that he did not carry out any test to determine the homogeneity of the pulverized substance as there was no way to test it;

(6) that he had no perception of the degree of homogenization achieved by the use of a blender nor of the actual degree of homogenization of the powder achieved by the blender used by him, but that he believed that a high degree of homogenization was achieved because the actual results of the HPLC tests showed that there was only a variation of heroin between the three samples of not more than 5% (actually 3.1% based on P14, P15 and P16, ie 27.7% – 24.6% or 4.69% (27.77% – 23.08%) if the GCMS results are taken into account);

(7) that he had weighed out samples A and B first, and after he had sealed the plastic bag *and before any test was done*, Dr Chow instructed him to weigh out sample C because Dr Chow, on pre-calculation, noted that the amount of heroin was likely to hover around 15g (Loh used the expression 'critical case');

(8) that the taking of the third sample accounted for the additional subtraction of 0.1532g from the final weight as written in P23;

(9) that he made a subtraction error as to the weight of the powder that was returned to the police, but denied he was careless as he was subject to the pressures of daily sampling, and that even Dr Chow did not detect the error and that he detected the error only about a year ago; that he had never used chloroform before in his preparations of specimen samples for testing heroin;

(10) that apart from the internal standard and the heroin standard, he did not use a control (ie a sample of which the answer is known) to monitor his tests;

(11) that he did not follow the instructions in the manual in preparing the samples for the HPLC analysis as the manual was prepared in 1980 for the Hewlett-Packard 1084B (with a RP8 column) whereas he used a Philips Pye Unicam (with a RP18 column) and that the change in conditions was approved by Dr Chow;

(12) that in preparing the samples for the GCMS analysis, he also did not follow the conditions written in the manual, eg in using methanol only as

a solvent instead of a mixture of chloroform/methanol as written in the manual, and that the change was approved by Dr Chow after a United Nations pamphlet had warned that chloroform was a carcinogen, and that he himself had never used chloroform as a solvent in his tests;

(13) that to his knowledge, the manual had not been updated as he had not received an updated copy, but later (after the lunch break) said that it had been updated in 1989;

(14) that he started doing HPLC and also GCMS work in 1983.

(2) Testimony of Tan Wang Chwee (PW11):

Tan has held the post of senior laboratory technician for nine years. He was attached to the Narcotics Division of the DSS since 1979 and assigned to conduct GCMS analysis. He confirmed that Loh handed to him five test tubes, four containing a sample plus internal standard (marked A, B, C and STD) and the fifth containing only a sample. The first four tubes were for quantitative testing and the fifth for qualitative testing. Before proceeding with the tests, he 'tuned' the instrument by using a compound (PFTBA) which is specially manufactured for that purpose. He then described how he carried out the said tests by injecting 1 microlitre of the sample only into the GCMS instrument which gave a positive reading of the presence of heroin (see spectogram marked P22 showing ions 327 and 369). He also confirmed that he performed the quantitative tests by making two injections each from tubes A, B, C and STD into the instrument. He used a syringe to make each injection and he cleaned the syringe 20 times before each injection. The instrument then took over and produced the data shown in P18, P19, P20 and P21.

Tan also confirmed that he made certain changes to some of the conditions written in the manual with the approval of Dr Chow, eg the length of the column (1m instead of 2m), oven temperature (from 250 degrees to 200-300) etc. He also said that the instructions to change the conditions were given by Dr Chow about one year after the installation of the instrument and that these instructions were not in writing or recorded by him (Tan) in writing, and so he relied on his memory when conducting the tests.

(3) Testimony of Dr Chow Shui Tse (PW12):

Dr Chow is the principal scientific officer in the DSS and has a doctorate in chemistry from the University of Manchester. He has about eight to ten years experience in the analysis of diamorphine and related drugs while working in the DSS. He underwent training in drugs analysis in the Drug Enforcement Administration, USA in 1978/1979. One of the courses he did for his Bachelor of Science degree from Nanyang University was statistical analysis. When he was doing analysis of heroin in the DSS he handled about 150 cases a month and had been certifying the results of such analysis for the purpose of s 16 of the Misuse of Drugs Act (Cap 185, 1985 Ed) ('the Act').

He gave a certificate dated 8 October 1986 under s 16 of the Act. The certificate reads as follows:

> I found the contents of the envelope to be one plastic packet containing 110.45g (nett) of granular substance which I analysed and identified the presence of diamorphine by thin layer chromatography, infrared spectrophotometry, and mass spectrometry.
>
> I then estimated the strength of diamorphine in the sample by (i) high pressure liquid chromatography, and (ii) gas chromatography/mass spectrometry, and obtained the following results:
>
> i) 24.6% weight by weight of diamorphine,
> ii) 23.1% weight by weight of diamorphine.
>
> Using the lower of the above results, and making an allowance of six times the coefficient of variation of 4.4%, the strength of diamorphine in the sample is 17.0% weight by weight. The amount of diamorphine in the sample was therefore not less than 18.77g.
>
> Diamorphine is a Class A controlled drug listed in the First Schedule to The Misuse of Drugs Act 1973.

In his testimony, Dr Chow made the following statements:

(1) that he used two methods to determine the amount of heroin in the seized packet: the HPLC (results as shown in chromatograms P14 to P17) and the GCMS (results as shown in spectograms P18 to P22), that he employed these methods whether the amount of material was large or small: that the methods were reliable and accurate and the best and most up to date available: that in the present case, he used the Philips Pye Unicam for the HPLC tests and the Hewlett Packard 5985B for the GCMS test: that he had conducted co-laboratory tests of his HPLC and GCMS methods with the Laboratory of Government Chemists, London (which does narcotic tests for HM Customs) and found them to be accurate and reliable;

(2) that the conditions as printed in P14 to P17 had been tested by him and Loh and Tan were given instructions to run their analyses on those conditions and that both the HPLC and the GCMS instruments automatically analysed and calculated the percentage of heroin in each of the samples;

(3) that from the results in P14 to P18 he calculated a value, known as the standard deviation ('SD') (see formula in P40), to 1.14. From this figure he calculated another value (by dividing the SD with the mean value of all the 18 results, and known as the coefficient of variation (CV)) to be 4.4 (see P43 for calculations) which he found to be satisfactory;

(4) that in calculating the weight of the heroin, he used the mean value of the 18 results (= 25.58%), multiplied that by the weight of the exhibit, ie 110.45g = 28.27g, and that when giving an allowance of 6 SD or CVs for the figure of 28.27, he would get 20.81g, but that if the allowance was based on the lowest of the 18 results (which was 23.1%), he would get 18.77g;

(5) that in accordance with the practice of the DSS in prosecutions for trafficking in drugs, the lowest figure was used and Dr Chow said he was sure that the weight of the heroin in the exhibit was not less than 18.77g;

(6) that the difference between 15g and 18.77g was 3.77g = 25% and that there was no possibility of the instrumentation being so unreliable as to commit an error of that magnitude from the set of data he had;

(7) that the grinding of the substance with the blender would homogenize the sample, the random sampling of three samples for analysis would ensure the homogeneity of the sample: duplicate injection would ensure instrument reproducibility: using two different methods was to eliminate inherent bias from a particular instrument: giving a statistical allowance (of 6 CV) would give absolute certainty that the weight would not be less than a particular amount (of 18.77g): all these steps ensured that all experimental errors have been taken care of;

(8) that statistically, the probability of the amount of heroin weight in the exhibit being less than 20.81g was 1:10,000,000;

(9) that he instructed Loh to weigh out a third sample after the qualitative but before the quantitative tests;

(10) that he approved the method of homogenization by the use of an ordinary kitchen blender (three runs for 5 minutes each) as the method was recommended by a UN Committee.

During cross-examination, Dr Chow made the following statements:

(11) that he was mistaken when he said at the preliminary inquiry that he had used chloroform/methanol as a solvent and that he agreed that if he had used that method it would have been a wrong approach;

(12) that operating procedures should be written in a laboratory manual but that sometimes it was necessary to rely on oral instructions because of different conditions, and that the performance of the person actually doing the work was equally important;

(13) that, from experience, the use of a kitchen blender (three runs of 5 minutes each) was sufficient to homogenize a granular substance (like the exhibit), that he could not tell the level of homogeneity (whether it was 80% or 90%), that he had looked at the powder and was satisfied with its homogeneity, but that he did not rely on visual inspection alone but also on the results of his final analysis, ie where the final results of three randomly taken samples were consistent, the exhibit would be homogenous;

(14) that he was not aware that there were other methods to determine whether a mixture of substances was satisfactorily homogenized;

(15) that he did not agree that to calculate properly the SD and CV in the analysis of a powdery substance, the analysis should perform replicate analysis at least ten times on different samples;

(16) that he had to rely on the set of 18 data to come to a significant and conclusive result and that he saw no significance in the highest and the lowest of the 18 data having a variation of more than 20% between them;

(17) that he did not check the number 393 in the spectogram (P22) as he was of the view that it came from electrical background noise in the instrument and not from an interfering compound which could have distorted the accuracy of the quantitation of the heroin calculated by the instrument;

(18) that the proper procedure was to analyse one sample without the internal standard on each instrument, that he did this for the GCMS but not for the HPLC;

(19) that the SD and the CV were intended to correct any unavoidable and avoidable (including human errors); that he could not agree that the same SD could not, statistically, cover the results from two different tests or processes (here, the HPLC and the GCMS) as the processes were for the same purpose (quantitation);

(20) that he did not agree that his 18 sets of data (6 from 2×HPLC, 2×GCMS, 2×369) × samples A, B and C were not capable of establishing the homogeneity of the exhibit where the samples were taken at random, and that the results of the tests proved the homogeneity of the exhibit;

(21) that the correct figure for the CV was 4.46 and if rounded up would be 4.5 (instead of 4.4) and that the weight of the heroin on 6 CV of 4.5 would have been 18.61g; that the CV was not only the CV of variation of the injection on the chromatogram and the variation of the total extraction from the powdered exhibit but covered the variation from the entire analysis, including the performance of the analyst, ie the variation in sample preparation (starting at blending), the variation in sample homogeneity and the variation in instrumental analysis;

(22) that whatever had been done by the technicians in the preparation of the samples, the weighing etc was accurate and could be verified and that he did not agree that they could not be verified;

(23) that the taking of random samples and analysing them is one of the best ways to ascertain its (the blended powder) homogeneity: and that using three samples taken randomly will ensure that they are representative of the entire bulk (of the powdery substance).

In re-examination Dr Chow said that he was satisfied that 18 results from the three samples proved that sufficient homogeneity existed in the whole bulk. He also confirmed that if he had used two decimal points in his final calculation instead of one, the weight of the heroin would be 18.61g, but that if he were to take into account *all* the decimal places (ie four) in the 18 results, an SD or CV of 6 on the *lowest* of the 18 results, the weight of the heroin would be 18.67055g.

On the basis of the above evidence and the ruling in *Haw Tua Tau*,[1] we ruled against counsel for the accused that there was no case to answer. We found that there was a case to answer on a charge for trafficking in not less than 18.61g (which was the weight calculated by counsel for the accused on the basis of using two decimal points). The accused was then asked to plead to the amended charge. He pleaded not guilty and elected to keep silent but called an expert witness to testify on the validity of the tests carried out by Dr Chow. The defence was based substantially on this expert evidence.

Equal protection of the law — art 12(1) of the Constitution

Before we consider the evidence adduced by the defence, we think it is appropriate at this juncture to record herein our reasons for the two rulings on the law which we made in connection with the submission of no case to answer. The first was the submission by counsel for the defence that the prosecution was not entitled to change the rules and formula on which it computed 18.77g as the 'official' weight of the heroin. The foundation of this argument was Dr Chow's evidence that in all drug trafficking cases, he would use an allowance of 6 CVs and the mean weight of the three averaged results from the 18 data to calculate the weight of the heroin in any mixture tested by him. On this basis, counsel contended that if either the allowance of 6 CVs and/or the mean weight are/is wrong, the prosecution should not allowed to justify their measurement on some other method of computation as this would deprive the accused of his constitutional right to the equal protection of the law under art 12(1) of the Constitution. This objection was later on renewed when the DPP sought to put forward the weight of 18.67g if the calculation was done to four decimal places from the 18 data.

The thrust of the argument appeared to be that the DSS had all along treated equally all persons charged with trafficking in drugs by the application of the aforesaid formula and to change it as against the present accused would discriminate against him unlawfully. Counsel cited the following authorities on the equal protection doctrine: *The Press Trust of India* v *Union of India*;[2] *Yick Wo* v *Hopkins*[3] and *Jain on Administrative Law of Malaysia and Singapore* (1980) at p 274 and pp 276-277. We do not need to examine these authorities. In *Howe Yoon Chong* v *Chief Assessor & Comptroller of Property Tax*,[4] the Privy Council held that the equal protection clause is contravened if there is deliberate and arbitrary discrimination against a particular person. Arbitrariness implies the lack of any rationality. This could not describe the attempts of the DPP to justify the results of Dr Chow's analysis on some other basis which is not scientifically or logically invalid. We do not think that because Dr Chow has consistently applied to drug trafficking cases a formula the factual basis of which, as claimed by counsel, is erroneous, that Dr Chow was entitled to prove from the same results, subject to such allowances as might validly be given to them, that the amount of the heroin was more than 15g or even more than 18.77g. After all, the charge was that the accused had trafficked in *not less than* 18.77g before it was amended. We do not think that there is a constitutional protection against the application of correct scientific formulas and facts to any prosecution of accused persons.

Admissibility of computer printouts

The second point of law raised by counsel for the accused was that P14 to P22 (the chromatograms and the spectrograms and the worksheet) were not admissible in evidence in that (1) they were copies and not originals, and (2) they were computer statements. As regards (1), it was contended on the evidence that Dr Chow had failed to satisfy the conditions set out in s 67(c) of the Evidence Act (Cap 97, 1985 Ed). We rejected this submission on the ground that Dr Chow had satisfied the statutory conditions for the admission of the copies. He had ascertained that the computer tape or disk which recorded the 18 data had been erased and a search in his office also did not find the original printouts. It has to be remembered that the copies of the printouts were tendered as exhibits at the preliminary inquiry without any objection from counsel for the accused (which, presumably, induced the examining magistrate not to have regard to the conditions in s 67), and it was only at the trial before us that it was discovered that the original printouts were not tendered. Furthermore, counsel for the accused himself had accepted the secondary evidence when he made use of it to cross-examine all the prosecution witnesses.

The next objection as to the admissibility of P14 to P22 was that the conditions of s 35 of the Evidence Act (Cap 97, 1985 Ed) had not been compiled with. Section 35(1) provides as follows:

> In any proceedings, a statement contained in a document produced by a computer shall be admissible as evidence of any fact stated therein of which direct oral evidence would be admissible, if it is shown that the conditions mentioned in subsection (2) are satisfied in relation to the statement and computer in question.

Section 35(2) stipulates four conditions.

Counsel contended that the four conditions had not been complied with. He referred to the decision of *Aw Kew Lim* v *PP*.[5] The DPP did not contend that s 35 had been complied with but contended that it had no application as it was intended to apply to evidence which was hearsay and not real evidence. His contention was that the computer evidence as recorded in P14 to P22 was real evidence and not hearsay evidence. We accepted this submission as the computers in the HPLC and the GCMS instruments not only recorded but also processed and calculated the information fed into them and Loh, Tan and Dr Chow had given oral evidence in regard to these matters and also on the data that was thereby processed. The evidence contained in P14 to P22 was confirmed by the oral evidence of these witnesses, unlike in the case of *Aw Kew Lim*[5] where only the computer printout was tendered in evidence and the printout was nothing more than a regurgitation of the information fed in by the Companies' Registry officers. It was truly hearsay evidence in that case. Section 35 applies only if the computer printouts are put in as evidence of the facts stated therein without more.

In *R* v *Wood*,[6] a question arose as to the admissibility of computer printouts in s 1(1) of the Criminal Evidence Act 1965 which provided:

> In any criminal proceedings where oral direct evidence of a fact would be admissible, any statement contained in a document and tending to establish that fact shall, on the production of the document, be admissible in evidence of that fact if (a) the document is . . . a record relating to any trade or business and compiled . . . from information . . .

The computer printouts contained the results of the chemical composition of various metals which had been subject to laboratory tests and the figures produced were then fed into a computer which did all the requisite calculations. At the trial the printouts were admitted in evidence to prove that certain metals stolen by the accused came from the said metals as their chemical composition was the same. On appeal, the Court of Appeal held that the printouts were inadmissible under s 1(1) of the said Act because they were prepared for the purpose of the prosecution of the appellant and not in the course of trade or business, but that nevertheless being the product of the computer which had been used as a calculator, the programming and use of which was covered by oral evidence, the printout was real evidence under the common law.

R v *Wood*[6] was followed in *Castle* v *Cross*[7] (in relation to the admissibility of the test record printout of an automatic breath-testing device) which latter decision was again applied in *Garner* v *DPP*.[8] In our view, the principle established in these decisions that the product of mechanical devices, such as computers and calculators, is real evidence applies to the data contained in P14 to P22. Such evidence is not subject to s 35 of the Evidence Act.

Case for the defence

We now consider the case for the defence which is based entirely on the evidence of Dr Toseland, a consultant toxicologist with the Clinical Chemistry Department, Guy's Hospital, London and also the senior lecturer in forensic medicine in Guy's Medical School, University of London. He was a Fellow of the Royal College of Pathologists, the immediate past President of the British Academy of British Sciences and a member of the Drugs Abuse Committee of England, which is a quality assessment committee of hospital laboratories in their performance of monitoring drugs in body fluids. He has served in a similar committee established for the EEC. He has published about 80 papers on the subject of toxicology since 1965, given expert evidence on toxicology in many courts in many countries, and in England has given evidence mainly for the prosecution. He has also conducted qualitative and quantitative tests of heroin and other drugs and has employed the HPLC (for 11 years) and GCMS (for six years) methods in his analyses of heroin and cocaine.

Dr Toseland's main points in relation to the laboratory procedures and the analyses employed by Dr Chow were as follows:

(1) that laboratory instructions for the carrying out of scientific analysis should be recorded in writing in a book or manual, and maintained current at all times and any changed procedure must be eradicated completely from the manual, and that it is bad laboratory practice to give instructions on how to do an analysis by word of mouth;

(2) that in carrying out laboratory work in accordance with such instructions, technicians or assistants must record exactly what they do;

(3) that a visual examination of the blended powder (which was pinkish) was 'no guarantee' of its homogeneity, and that there are at least three ways to test the homogeneity of any blended powder: (i) the use of a fluorescent substance; (ii) introducing an internal standard into the bulk (but that this was not suitable here as the amount was too large); and (iii) the use of a radioactive substance;

(4) that the first method involves putting a milligramme or two of a non-reactive fluorescent dye into the centre of the bulk which is then ground overnight or longer in an industrial grinder (a container containing about 12 rotating steel balls); the ground material is then spread out evenly on a glass block and then inspected in a dark room under ultra-violet light; the UV light detects the spread of fluorescent in the ground material; it is a more accurate form of visual inspection than by merely looking at the colour of the ground material;

(5) that the third method is to introduce a tiny amount (so small that it cannot be weighed) of a tritium labelled heroin sample (ie which is highly radioactive) into the bulk, which is then ground in the same way as described, after which four samples are taken from four different areas of the ground material and then dissolved in a fluid and the bottles containing the fluids are then put onto a scintillating counter which counts the radio-activity of the samples per minute per unit weight: these results are then compared with the counts for an equal amount of pure tritium which is put on and counted by the scintillating counter; the results of one should be more or less the same and the variation should not exceed by more than 5% (after taking into account a CV of 1.7% for the counting based on a count of at least 20 samples established previously by an equivalent experiment on another material at the same level he was working);

(6) that the taking of three random samples in the instant case did not prove that the bulk from which they were taken was homogenous, and as Dr Chow did not pre-test the bulk for homogeneity, it was not possible to tell whether any variation in the results of the analysis was due to the lack of homogeneity (which is an avoidable error) or to the CV or SD (which is due to unavoidable errors);

(7) that Dr Chow's method of using the CV to cover both avoidable and unavoidable errors was wrong and that it was also wrong to calculate and use the same CV to cover two separate analyses done on two different instruments by two different persons; and that the SD measures the precision of the tests but not their accuracy and that the SD for each analysis should be computed separately;

(8) that it was wrong to use the analysis to derive the CV (as statistics cannot validate three results to give a calculated CV) and that the CV should have been worked out separately (using not less than 20 samples); and tested against the ability of the technicians to match the requisite degree of precision (which would be 11% per microlitre per millilitre of blood for morphine in blood or 2% for alcohol in blood) before they are allowed to conduct the analysis;

(9) that for Dr Chow to regard the taking of three samples and testing each of them six times as giving 18 results was wrong and that there could only be three results averaged from the six results for each sample;

(10 that a variation of 20% between the lowest and highest of the 18 data was unacceptable scientifically and the analysis should have been done all over again;

(11) that in addition to using the internal standard in the analysis, a control standard from the same sample should also have been used to test the efficiency of the technicians as it would guarantee the accuracy of the analysis;

(12) that after the bulk has been tested for homogeneity, he would take three samples for testing for HPLC and GCMS analysis, using two injections and thereby giving 12 data;

(13) that the fact that the conditions for the analyses by the HPLC and the GCMS methods are printed in the chromatograms do not prove the accuracy of those conditions as there was no manual from which those requirements can be verified;

(14) that the United Nations' manual for testing heroin setting out the various methods of homogenizing granular substances were in general terms;

(15) that the 18 data from the HPLC and GCMS tests of Dr Chow do not prove the homogeneity of the bulk but only the homogeneity of the three samples, and even then it was doubtful whether the three samples were homogeneous since there was a variation of more than 20% between the lowest and the highest data;

(16) that there was nothing wrong with the procedures adopted by Dr Chow or the use of three samples for HPLC and GCMS testing in the way he had done, subject to what has been said above.

Findings of court

We have, we believe, summarized all the material evidence adduced at this trial. It is not necessary for us to comment on the various tables of calculations and graphs or the employment of the Gaussian distribution curve to work out the degree of probability of the weight, as calculated by Dr Chow. These are either mathematical or scientific facts or formulae which were not in dispute. In our view, however, they could not affect the central issue raised by the defence regarding the degree of homogeneity of the exhibit in its pulverized condition at the time samples were taken from it for quantitation.

The defence's criticism of Dr Chow's analysis falls into two categories: (1) a general attack on the less than rigorous approach of Dr Chow and his technicians to

scientific analysis and laboratory practice with particular reference to be analysis of the exhibit forming the subject matter of the charge against the accused; (2) specific attacks on the actual procedures followed in the quantitation of the diamorphine and the calculation and use of the CV or SD for the purpose of calculating the weight of the exhibit.

The first criticism in the first category was that of a failure to update the laboratory manual after the conditions for the GCMS analysis were changed to meet the requirements of the new instrument and that to perform the tests, Loh was relying on memory each time he performed such tests. Loh himself admitted that he had never seen an updated version of the manual up to the date of the trial although, on checking in the course of the trial, he confirmed that it had been updated in 1989. Thus the situation was that not only was the manual not updated at the material time, but also that when it was updated Loh himself did not know about it as he was not provided with a copy. The same comment is applicable to the other technician, Tan. The second criticism was that Loh kept no notes at all of the steps he took. The point is without such notes it would not be possible to determine whether he had followed the prescribed steps. This comment does not apply to Tan as all he did was to put the sample in the GCMS instrument which would automatically analyse the sample and print out the data. Dr Chow said that all the instructions could not be reduced into writing as changes had to be made on an ad hoc basis according to the circumstances. However we do not think that this answered the absence of a manual in this case. The DPP has contended that the absence of a manual did not matter and that what mattered was the level of performance of the technicians. Dr Toseland readily agreed to this proposition except that in his view one would not have any record to make an objective assessment of the level of the performance of the technicians. Human memory is a frail thing and that is why, generally, things are best remembered if recorded in writing. For the purpose of evaluating a scientific experiment or a laboratory analysis, the written record is absolutely vital. In the present case, the level of performance of Loh can be, to a certain extent, judged from the fact that he made a simple subtraction in writing which was wrong and which he and Dr Chow did not even detect until about a year ago. Loh said that the mistake was made due to 'the pressures of daily sampling'. We do not doubt the explanation but it proves the very point that the defence was asserting. We should point out that Loh admitted that on the day in question he analysed only the three samples in question and no others. Similarly, as an irrefutable illustration of the frailty of human memory, when Dr Chow gave evidence in the preliminary inquiry on this case on 10 September 1987, about a year after the accused was arrested, he could not even remember that he had changed the conditions for the testing of heroin and kept on referring to a previous but discarded method using a mixture of chloroform and methanol! Furthermore, in the instant trial, Dr Chow also could not remember whether he had tendered the originals of P14 to P22 at the preliminary inquiry.

The DPP has made the point that as the conditions are reproduced in the spectrograms, that is evidence that the analysis was done on those conditions and, given the undisputed reliability of the instruments, the validity of the analysis can be proved. Dr Toseland agreed with that proposition provided, as he correctly pointed out, that the technician has actually complied fully with those conditions and also that the technician has entered the conditions correctly in the instrument. The point was that in the absence of a laboratory manual and/or notes of the preparatory steps, the recorded entries in the GCMS instrument proved nothing about accuracy of conditions or of performance.

Dr Chow was also criticized for his lack of consistency in his use of decimal points to calculate different factors that went into the calculation of the final weight, eg (i) he derived a CV of 4.4% from 4.6% when it should have been 4.5% if rounded up to one decimal point, and (ii) he rounded up 25.08% to 26.1% to calculate the weight. It was pointed out by counsel, correctly, that both the figures were rounded up in a way which made the final weight heavier. It was for this reason that we amended the charge to reflect a lower figure of 18.61g. It was also for this reason that when the DPP did a calculation of the weight using all the decimal points in the data, he came to a weight of 18.67g. The DPP's reply was that the small variations in the figures did not matter as they were not material to a charge of trafficking in not less than 15g. The reply misses the point as it does not answer the point that there was an absence of a consistent practice or standard, rigorously and consistently applied to the calculation and analysis. We accept this criticism from a scientific point of view.

For the above reasons, we accept the general criticism that the laboratory procedures prevailing at the time the tests were done on the exhibit were not sufficiently rigorous in terms of the standards required of scientific analysis of drugs. We are constrained to agree with this criticism not only because the highest standards of laboratory practice should be followed at all times in respect of any analysis, whatever its purpose may be, but particularly on an occasion when, the result of the analysis was literally a matter of life and death for the accused!

Coming now to the specific criticisms, the first is that Dr Chow's analyses of three samples by the HPLC and the GCMS methods, whilst giving three average

percentages of the heroin in the three samples, did not give an accurate or true weight of the heroin in the bulk as there was no evidence that the bulk itself was homogenous (in the sense of the distribution of the heroin compound being evenly spread amongst the other compounds) or rendered sufficiently homogenous by the taking of three samples therefrom. The three results were capable of showing the homogeneity of the heroin content in the three samples but here it could not be demonstrated convincingly as the lowest and the highest data differed to the extent of more than 20%. We think this is a valid criticism. The HPLC and the GCMS instruments were designed to perform qualitative and quantitative tests respectively. They are not primarily designed to test homogeneity, although they are capable of doing that if the whole or a sufficiently large part of the bulk was used.

The DPP answered this criticism by contending that the actual testing of the three samples by the HPLC and the GCMS methods was a superior way to determine homogeneity as demonstrated by the small variations in the 18 data produced from the three samples which were taken randomly from the bulk. Unfortunately, this contention is supported neither by experimental evidence or scientific principle. Firstly, there is, in our view, insufficient evidence that the three samples were taken randomly. The only evidence about how they were taken came from the lips of Loh who said, in answer to a question from the DPP, that they 'were taken from as far away from each other as possible'. What does this ambiguous answer mean? Loh had said that the granular substance, after blending, was emptied into a new plastic bag. We have seen the bag, which is not big. The samples were taken out at two stages, first A and B and later C. In this situation, we doubt very much that the three samples were taken randomly from various parts of the bulk; they could hardly have been far away from each other. As far as Loh was concerned, this was a routine analysis, and furthermore we observed that Loh was most anxious to defend the quality of his performance and yet was unable to be specific about how the three samples were taken. We find that the three samples were not taken randomly in the sense of a random sampling.

Secondly, given the possibility that the pulverized substance might not be homogenous in regard to the distribution of the heroin therein, the prosecution has produced no experimentally verifiable and verified evidence that the taking of three samples (assuming that they were taken at random) with a total weight of 0.4669g out of a weight of 110.45g, ie less than 0.46%, from a granular substance which has been blended by an ordinary kitchen blender in the manner described, is a valid or sufficient procedure to obtain a *representative* sample of the bulk. There is no evidence that Dr Chow had done any testing to satisfy himself that this procedure was valid for this purpose. It would seem that Dr Chow relied merely on the UN testing manual which referred to the methods of homogenizing granular substances in general terms. Also, the prosecution did not produce the actual blender used in this case, although both Loh and Dr Chow were cross-examined on its suitability and efficacy in blending a granular substance containing many chemical compounds into a homogenous whole. We were asked to examine the condition of the actual pulverized substance, which we did, but that told us nothing about homogeneity of the contents or even the uniformity of the colour since it is agreed that the exhibit had since undergone some chemical change.

We do not think that the DPP's contention can be valid as a matter of scientific principle or logic. It is only valid if one or other of two assumptions are made: (1) that the bulk was homogenous, in which case, of course, as Dr Chow himself said, one sample for testing would be sufficient, or (2) that three samples, even if randomly taken, of less than 0.46g of the whole bulk, were representative of the bulk for the purpose of determining homogeneity. Much of the DPP's cross-examination of Dr Toseland's evidence was conducted on one or other and sometimes both of these assumptions. The fact remains and it is not disputed that neither Loh nor Dr Chow had tested the pulverized substance for homogeneity before the analysis was done. It was assumed that blending the exhibit in that way made it sufficiently homogenous and that the taking of three samples with a weight of about 0.46% of the whole would give an acceptable degree of homogeneity for the purpose of calculating the amount of heroin in the exhibit.

Now, Dr Toseland has described two methods which can be used to determine whether a ground or pulverized granular substance can be tested with great accuracy as to homogeneity. He has also given evidence that he had tested the end products when using these methods and was satisfied that using four samples would be sufficient to test homogeneity. The theory of both the methods, it seems to us, is that if the fluorescent dye is seen under UV light to be evenly distributed amongst the substance, or, in the case of tritium labelled heroin, the count is more or less the same in four samples taken from four different areas, then the likelihood is that the slow and long process of grinding has also distributed the other compounds evenly. The importance of Dr Toseland's evidence on this point lies not in the grinding method that is used but in the testing of the method for the degree of homogenization achieved by it. The prosecution has offered no such evidence in respect of the use of the kitchen blender.

Finally, we have the prosecution's own evidence of a difference of 20% between the lowest and the highest data from the three samples. Dr Toseland's evidence on

this result was that on the basis of the preparatory procedures used in this case it would not be possible to explain how this result came about, ie whether it was due to the 'dissolved' samples not being homogenous (and here we should add that Dr Toseland said his own procedure would involve filtering the solution to ensure that all the undissolvable material is removed, which Loh did not find it necessary to do because he was satisfied that the sample was dissolved entirely) or to the method of analysis. It was a matter of speculation and Dr Toseland speculated that the two data could mean that the samples were not homogenized. If within two samples (the data came from sample A and sample B), there is a doubt about homogeneity, there must be a greater doubt about the homogeneity of the bulk.

In connection with Dr Chow's belief that the mean results of the three samples showed a high degree of homogeneity, we think that we should refer to one aspect of the prosecution evidence which has puzzled us. It will be recalled that Loh testified that sample C was taken out soon after samples A and B (after he had sealed the plastic bag) but before any test was done. He also confirmed this statement by the manner in which the subtraction entries were made in his working sheet (P23). He said Dr Chow instructed him because, on pre-calculation, the amount of heroin would hover around 15g. He said that Dr Chow had used the expression 'critical case'. Dr Chow confirmed that sample C was taken out before the quantitative test was done. However, when the court asked Dr Chow what he had meant when he told Low that it was a critical case, he replied that it was simply a case where the exhibit was more than 15g. In other words, it was not critical in the sense as understood by Loh. Now, we have checked the times (as recorded in P14 to P17) of the analyses of samples A, B and C. The calibration with the internal standard was done at 09:47:38, followed by A at 10:21:57, followed by B at 10.56:16, followed by C at 12:05:22. Sample C was in fact analysed much later, more than an hour later. Why? Could it be that Loh's evidence was correct and that of Dr Chow wrong? It is difficult to think of another explanation which fits the evidence. If this is correct, then what had happened was that Dr Chow was not satisfied with the high discrepancy between the highest datum from sample A (27.77% for HPLC) and the lowest datum from sample B (23.08% for GCMS) and therefore instructed that a third sample be analysed, the results of which he accepted, with the consequence that the mean value of the 18 data has been increased. If our explanation for what Dr Chow did is correct, and the evidence tends to suggest that it is correct, we have grave doubts as to the integrity of the entire analysis.

For the reasons given above, we find that the prosecution has not proved beyond reasonable doubt that the weight of the heroin as calculated from the analysis of the three samples was representative of the remaining 99.5% of the exhibit.

The second specific criticism of Dr Chow's methodology relates to (i) the calculation of the CV from the actual tests themselves and not independently, and (ii) the use of the same CV for two tests carried out by two different persons with two different instruments. In the instant case, Dr Chow obtained a CV of 4.4% which was resultant of the SD of 1.14 divided by the mean value of all the 18 data (= 25.58%). The SD was worked out according to a statistical formula which was accepted by Dr Toseland. In his pre-trial report, a copy of which was given to the prosecution before the trial started, Dr Toseland made the point that he did not know whether the CV of 4.4% for one SD used by Dr Chow to calculate the weight of the heroin represented (a) the CV of the variation of the injection on the chromatogram or (b) the variation on the total extraction from a mixed powdered heterogeneous sample that has been treated in like fashion, and whether the CV contained some element of the process of preparation of the homogenous sample. Dr Chow's answer was that his CV represented both the avoidable and unavoidable errors and to make sure that any error in this method is compensated for, he gave an allowance of 6 CVs for his final calculation. It appears to us that what he has done was to short-cut the many steps which Dr Toseland maintained was required of a properly conducted laboratory analysis of drugs. Our impression of this aspect of Dr Chow's evidence is reinforced by the evidence of Tan that Dr Chow instructed that certain changes be made to the conditions of the GCMS test to shorten its analytical time to achieve greater productivity!

On the basis that the CV is relevant only to discount unavoidable errors (as in the nature of scientific analysis, it is impossible to get the same results in any two analyses) and not avoidable errors, this criticism *appears* to us to be justified. We have formulated our finding in this way because in the face of contending expert evidence on scientific matters, we are really not in the best position to make a finding as to which expert is right. In this respect, we would like to add that in the face of a dispute between experts as to the proper method of calculating the CV for such analysis, it is incumbent on the prosecution to produce additional expert evidence, perhaps from the writings of other internationally accepted experts in this field of knowledge. Otherwise, the court is left in a position, as this court is, where it can only come to one conclusion that the defence has thrown a reasonable doubt on the validity of the prosecution evidence on the point. No such evidence was adduced to show that Dr Chow's method of calculating and using his CV was a better method for the analysis in question. The DPP's argument that the allowance of 6

CVs would take care of everything is not, in our view, proof that it is a better method.

It may well be that even if Dr Toseland's views are correct, any error on the part of Dr Chow has been corrected or alleviated by giving an allowance of 6 CVs for the calculation of the weight, although if the CV is used for this purpose, there is no reason why it should be 6 CVs and not 12 or any larger or smaller number. In fact, as the DPP was anxious to demonstrate by using many charts and statistics, the 6 CVs were used to ensure that there was only one chance in 10 million that the amount of heroin was less than 18.67g, *on the assumption that the three samples from which the 18 data were derived were representative of the bulk in relation to homogeneity*. This mathematical result cannot be disputed and Dr Toseland did not dispute it. But, unfortunately, it proves nothing in relation to the homogeneity of the bulk but only the relative homogeneity of the three samples.

To be fair to the prosecution and Dr Chow, it is not Dr Toseland's evidence that he believed that the weight of the heroin in the present case was less than 15g. He made no such claim. His evidence was only concerned with the correct preliminary steps and procedures to be taken for the 'ideal' or best analysis in the light of existing scientific knowledge. He was more concerned with the scientific integrity of the analysis conducted by Dr Chow which for the reasons he has given could have affected the validity of the result of a final weight of not less than 18.77g. The gist of his evidence is that the analysis was not *scientifically valid* for the results that are being claimed by the prosecution. Counsel for the defence has gone further to claim that the weight was not even mathematically valid if Dr Chow had followed his own procedure in using two decimal points in his calculations!

On the evidence before us, we would have no doubt whatever that if the prosecution's case were dependent entirely on its proving that the weight of the heroin in the exhibit to be not less than 18.77g (or as amended, 18.61g), the case has not been proved beyond reasonable doubt. However, there is no doubt whatever that there was a certain amount of heroin in the exhibit and since the trafficking of *any* amount of heroin is an offence, we need to go further to determine as best as we can from the evidence what that amount would have been if the analysis had been validly done (ie if there were none of the defects which we have found to have existed in this case).

In these circumstances, what has been proved with regard to the weight of the heroin? Counsel for the accused was not so unrealistic as to suggest that the accused should be acquitted altogether and so he has suggested that this court should make a finding of fact that there was not less than 10g and not more than 15g (by giving a further allowance of 20% to the lowest figure of 18.61g = 14.89g). Counsel has acknowledged that there is neither scientific nor evidential basis for this allowance and that he suggested it because there was no other evidence on which the court could act. The DPP, on the other hand, has contended that with the use of such accurate instruments like the ones used here and the experience of the technicians in the preparation of the samples for the testing, the allowance of 6 CVs for the calculation of the weight of the heroin and the reliability of Dr Chow's methods as found in correlation studies with other laboratories in the United Kingdom, it was impossible that such a big error of 3.61g (24.07% of 15) could have occurred. In other words, there was no reasonable doubt that the amount was more than 15g.

The criminal standard of proof requires proof beyond a reasonable doubt. It requires a high degree of probability. It should be noted that the word 'probability' as used in this context does not refer to the classical Pascalian theory of probability. In *Re JS (A Minor)*[9] at p 1066, the Court of Appeal said:

> The concept of 'probability' in a legal sense is certainly different from the mathematical concept; indeed it is rare to find a situation in which the two usages co-exist although, when they do the mathematical probability has to be taken into the assessment of probability in the legal sense and given its appropriate weight.

In the present case, the DPP has attempted to make use of the mathematical concept of probability to support his case when he questioned Dr Toseland on whether the homogenization process used by Dr Chow (blending three times for five minutes each) would, assuming it resulted in non-homogeneity of 20%-30%, give a degree of homogenization of 95%, 97% or 98%? Dr Toseland, quite rightly, replied that he did not have the remotest idea. We do not disagree that the mathematical concept of probability is applicable to determine whether the results of a particular sampling method, which is verifiable and is verified by actual sampling, is representative of the whole. But, in so far as this case was concerned, there was no valid foundation for the application of that theory and therefore the question was unanswerable.

The question that we have to answer is whether the prosecution has discharged the high degree of probability that the amount of heroin in the exhibit was not less than 15g although they have not proved with the same degree of probability that it was not less than 18.61g. To put the question in another way, has the defence raised a reasonable doubt that the amount of heroin might be less than 15g? Counsel for the defence contends he has but he does not contend that it is less than 10g. The DPP's only argument is that even if all the

criticisms of the defence are justifiable, there is no doubt that the amount of heroin was more than 15g as it was impossible for Dr Chow and his technicians, who had used reliable techniques and reliable instruments to do the analysis, could have erred to the extent of 24.07%.

In our view, the DPP's argument cannot even be proved by the application of mathematical probability as there is no evidence as to the probabilities of Dr Chow making an error of this magnitude. Furthermore, if the pulverized exhibits were not homogeneous and the taking of three samples with a total weight of 0.466g, *assuming* that they were taken randomly (as to which there is no satisfactory evidence), was not representative of the bulk, why should not the error be more than 24.07% in a case where we are dealing with small amounts of a powdery substance? The fact is no one knows the answer even as a matter of probability in the mathematical sense.

In *Miller* v *Minister of Pensions*,[10] Lord Denning attempted to define the expression 'without any reasonable doubt' in this way:

> If the evidence is so strong against a man as to leave only a remote possibility in his favour, which can be dismissed with the sentence 'of course it is possible, but not in the least probable', the case is proved beyond reasonable doubt, but nothing short of that will suffice.

For the reasons we have given, we are unable to say that there is only a remote possibility in favour of the accused in the instant case. In *R* v *Van Beelan*,[11] the Full Court of the Supreme Court said:

> It is not easy to find direct authority for what may seem to be an obvious proposition in logic, that you cannot be satisfied beyond reasonable doubt of the truth of an inference drawn from facts about the existence of which you are in doubt.

The difficulty here is not with inferring the existence of heroin but with its quantity. There is no fact on which the court can draw an inference that the quantity was more than 15g but less than 18.77/18.67/18.61g except by inferring that there was no probability of Dr Chow and his team of technicians making an error of 24.07%. But, if the question is asked, 'Why not?', we think that it is un-answerable by reference to any fact, logic or mathe-matical probability.

In the circumstances of the present case, we have decided that the proper course for this court to take is not to accept the suggestion of counsel for the accused as it lacks both logic and rationality, but to apply the principle that where the court is, on the evidence, left in doubt as to whether the accused has committed an offence in a lower or a higher degree of seriousness, the court should make a finding in the lower degree, particularly in a case in which a finding in a higher degree will give rise to a mandatory sentence of death. Accordingly, we find the accused guilty of trafficking in not less than 10g and not more than 15g of heroin at the time and date stated in the charge. We convict him accordingly.

Order accordingly.

Solicitors: *Low Yeap & Co.*

Reported by *S Surenthiraraj*

Chye Seng Huat Construction Pte Ltd v Goh Chin Soon & Ors

HIGH COURT (SINGAPORE) — ORIGINATING SUMMONS NO 943 OF 1989
WEE CHONG JIN CJ
26 SEPTEMBER 1990

Land Law — Agreement for sale and purchase of property — Option — Sale subject to purchaser obtaining in-principle approval from relevant government authority within eight weeks of date of option — Approval not obtained — Whether purchaser could waive condition for the obtaining of approval — Whether vendor could unilaterally rescind contract — Whether vendor had to give reasonable notice before rescinding contract

Contract — Option for purchase of property — Construction of terms of option — Whether vendor could rescind contract unilaterally — Whether vendor had to give reasonable notice before rescinding contract

The respondents were the vendors ('the vendors') of a piece of property ('the property') who had granted an option to the applicant ('the purchaser') to purchase the property. The option provided, inter alia, that the sale was subject to the purchaser obtaining in-principle approval to construct three units of two-storey bungalows on the property by the end of the eighth week from the date of the option, and if such approval was not granted by then, the purchaser would have the option to give the vendors written notice to call off the sale and purchase. If the purchaser did not give the written notice as aforesaid, the vendors could forfeit the deposit and have the discretion to abort the sale or to consent to the purchaser proceeding with the sale.

The purchaser's solicitors wrote to the vendors' solicitors on 10 May 1989 stating, inter alia, that the application for the proposed erection of three units of two-storey bungalows had been rejected, and that the purchasers were prepared to enter into fresh negotiation for the purchase of the property at a reduced price. The eight-week period specified for the obtaining of the in-principle approval expired without such approval being granted. Subsequently, the vendors exercised their right to abort the sale.

The purchaser filed the originating summons asking for, inter alia, that the vendors were not entitled to abort the sale and that the option was subsisting and binding on the parties. The purchaser's solicitors argued that:

(i) the provision for in-principle planning permission to be granted at the end of the eight-week period was for the purchaser's benefit, and which condition he was therefore entitled to waive;